The Sydney County Council

TECHNICAL INSTRUCTION

Manual Volume **METER INSTALLATION** 1

Nº **7301**
Date **11/89**

Subject **GENERAL INFORMATION**

This Instruction sets out general information related to low voltage metering.

CONTENTS

1. SAFETY
2. PUBLIC RELATIONS
3. ARRANGEMENT OF WORK
4. DEFINITIONS
5. METER READING
6. CREEPING
7. ISSUE

1. SAFETY

The Technician must carry out his duties in a safe manner, taking care when entering construction sites. Safety equipment is to be worn or used where necessary.

The Electrical Safety Rules shall be adhered to when working on or near electrical apparatus or equipment.

As far as it is reasonably practicable work should be carried out dead. However, in the case of multi-customer installations, work may be carried out alive to avoid interrupting supply to customers, except that in no circumstances may a polyphase meter, polyphase control device or CT be replaced whilst energised. Also, before work proceeds on CT metering, the secondaries must be bridged out.

Whenever work is carried out alive care must be exercised to ensure that simultaneous contact is not made between active conductors or between an active conductor and neutral or earth. Insulated tools and safety equipment, such as gloves and rubber mats, must be used where necessary.

If work is to be carried out dead, equipment must be first proved dead by the use of test lamps.

When it is necessary for safety reasons to carry out work dead and it is not possible to make suitable arrangements with the customer to interrupt supply, the matter should be referred to the supervisor to organise an interruption. In this regard particular attention is drawn to B.S.I. 5900 concerning kidney dialysis machines.

Where isolation of an installation is required and cannot be achieved by the withdrawal of service fuses or other means of isolation at the main switchboard, an Access Permit is issued by the Operator. Access Permits are to be used in accordance with the Regulations for Working on the Sub-Transmission and Distribution System.

Wherever it is necessary to work on customers' mains and apparatus remote from the point of their isolation, a danger label must be attached at the point of isolation in accordance with the Council's Electrical Safety Rule 2.12 to prevent the inadvertent energising of the mains or apparatus. Labels for this purpose are held at each Area Establishment store.

Supervisors arranging metering work remote from the point of isolation (e.g. a remote metering position supplied through submains) shall include on the Metering Request Form CSS926 the fact that a danger label is required. A label shall be issued with the material for the job. The blank spaces on the danger label should be filled in by the Technician and the label attached to the appropriate circuit breaker, switch, fuse or isolator. On completion of the job the label should be removed and returned to the depot.

Where supply to a customer is interrupted to carry out work and the customer is not at home, a CSS 649 card is to be left at the premises to advise of the interruption.

The technician must carry out a final check of completed work to ensure that no electrical hazards exist. Unless other responsible Council staff remain in attendance, the technician shall not leave the work site, even temporarily, if there are any electrical hazards.

EVERY STEP IS TO BE TAKEN TO PREVENT ANY PERSON INADVERTENTLY COMING INTO CONTACT WITH LIVE CONDUCTORS.

Depending on the circumstances and without limiting the action to be taken, such steps can include ensuring that -

- all live conductors are correctly terminated;
- covers are correctly fitted to equipment;
- danger labels are attached where appropriate; and

- switchroom doors are closed and locked upon leaving the site.

2. PUBLIC RELATIONS

The Technician shall comply with the requirements of BSI No. 1027, "Public Relations - Field Activities".

3. ARRANGEMENT OF WORK

Work shall be allocated by means of a works order for each job. Each day's run is based on the following order of priority:

(a) Appointments

(b) Other jobs as allocated, having regard for order of date of receipt.

The day's run is also to be organised to minimise the distance travelled consistent with adhering to the above order of priority.

On completion of each day's work, the daily run sheet together with the associated forms are to be forwarded to the supervisor.

Where access cannot be gained to the premises to carry out the work, a CSS 600 card shall be left in the letter box.

All forms, cards and documents are to be completed whilst on the job so that all information may be gathered and then checked after completion of the documentation without having to revisit the job.

4. DEFINITIONS

4.1. INSTRUMENTS AND METERS

Current transformer – (CT)
: A transformer designed for the transformation of current to a lower value for measurement, protection or regulation purposes.

Energy-demand meter
: A meter with both energy and demand registers.

Frequency-receiving relay
: A relay which is sensitive to an audio frequency pulsed into the power network at a predetermined rhythm or rate and is used to control loads such as storage water heaters, street lighting, etc.

Maximum-demand indicator – (MDI)
: An instrument designed to record the maximum level reached by a quantity.

Time switch
: A switch designed to open and close at predetermined times.

Dual register meter
: A meter provided with two registers, which provide for registration of energy usage according to the time of day as prescribed by the conditions of the tariff.

Voltage transformer – (VT)
: A transformer designed for the transformation of voltage to a lower value for measurement, protection or regulation purposes.

Watthour meter – (Energy meter)
: A meter designed for measuring electrical energy.

4.2. METERING ACCESSORIES

Bridging link

A device designed to bridge out a meter at its connector block.

Button insulator

A porcelain insulator with a centre fixing hole for mounting under meter boards.

Connecting links

Links connected on the line side of meters to facilitate separate metering of portions of an installation.

Continuity tester

A battery-operated lamp and buzzer with two flexible test leads, or similar.

CT-bridging device

A short length of flexible conductor with battery clips attached to each end.

Flag lug

A pressed copper lug for the connection of small cables to either M12 or M14 studs.

Fuse extractor

An insulated tool used to withdraw and insert service fuses.

Low-voltage test block – (LVTB)

An arrangement of links designed to be connected in a low-voltage CT-metering circuit to facilitate meter testing and isolation.

LVTB short-circuiting plug

A device designed to bridge the current circuit at an LVTB.

Meter connector block

An arrangement of terminals, designed for connection to a meter to facilitate its testing and isolation.

Meter connector-block spanner

A spanner designed for use on a meter connector block.

Meter-identification label

A label affixed on or adjacent to a meter to identify the portion of the installation being metered.

Metering neutral link – (MNL)

A link to which neutral conductors from the service neutral link and meters and load-control devices are connected.

Paralleling links

Links connected on the load side of meters to facilitate portions of an installation being metered separately or in parallel as required.

Phase-sequence indicator – (PSI)

An instrument designed for use on a polyphase system to indicate the sequence in which the phases reach peak voltage.

Phase-sequence label

A label bearing the anti-clockwise phase sequence symbol.

Service spanners

A set of sockets, together with a common insulated handle, used in the securing or removal of 100-400 Amp service fuses.

Single-phase test load

A bayonet cap 100 W lamp, constructed as a portable hand lamp, with two flexible leads with a test prod and battery clip attached.

Note:When used for general lighting over a lengthy period, a lamp having a rating not exceeding 60W must be used.

Test lamps

An arrangement of two 240V 15W bayonet-cap lamps connected in series and suitably housed with two flexible leads and test prods.

Unmetered-supply label

A label "U/M" signifying unmetered supply.

Voltage Fuses

Three 10A HRC fuses used to protect the voltage circuits of CT-connected meters, mounted in a sealable moulded case.

4.3. SERVICE AND RELATED EQUIPMENT

Combination panel – (Comb. Panel)

A switchboard panel on which the service and customer's equipment are erected on the same panel on a fixed surround, other than a standard meter-box panel.

Consumers mains – (Con. Mains)

Conductors installed between the consumers terminals and the main switchboard.

Consumers terminals – (Con.Term.)

The junction of the Council's conductors with the consumers mains.

House-service cabinet – (Hse. Ser. Cab.)

An obsolete single-phase cast-iron cabinet housing a single service fuse and meter.

Multiple-installation – (meter module)

A group of eight or nine socket bases as shown on drawing Ref. No. E.I. 101.

Point of attachment – (P of A)

The position at which a service line is terminated on a customer's post, pole, building or structure.

Service board – (Ser. Bd.)

A wooden board usually mounted on wooden battens.

Service board - hinged – (H. Serv. Bd.)

A hinged service board 12 in. (300 mm) high x 18 in. (450 mm) wide.

Service box - compact – (Cpt. Serv. Bx.)

A weatherproof box designed to house both a hinged service board and a customer's hinged panel.

Service cabinet – (Ser. Cab.)

A 200/400 A service fuse cabinet.

Service equipment

Council-owned equipment installed within the premises of a customer.

Service fuse board - small

A service board 100 mm high x 325 mm wide, designed to accommodate 100 A service fuses and neutral link.

Service fuse board - large

A service board 225 mm high x 435 mm wide, designed to accommodate 100 A service fuses, neutral link and reducing links.

Service line/cable — (Ser. Line/Cable)

The Council's overhead mains or underground cable between the network mains and the consumers terminals.

Service surround — (Ser. Srd.)

An approved metal surround designed for mounting a service board or panel.

Service termination cabinet — (200/400 A Term. Cab)

A 200/400 A termination cabinet designed to house the connection between service cables in excess of 100A and consumers mains.

Service termination enclosure — (Term. Encl.)

An approved enclosure installed to house the connection of underground consumers mains to a service cable.

Socket metering

A system of metering using meters, relays and time switches plugged into socket bases.

Standard meter box — (SMB)

The approved standard meter box shown on drawing No. E.I. 107.

Standard meter-box panel — (SMB Panel)

The standard panel shown on drawing No. E.I. 103.

Termination box - 80A — (80A T.Box)

A moulded plastic termination box, designed to house the connection of 80A service cable and consumers mains where a service termination enclosure is not practicable.

Termination box - 100A — (100A T.Box)

A moulded plastic termination box, designed to house the connection of 100A service cable and consumers mains.

Weatherproof box — (Wp. Box)

Any weatherproof box, other than the compact service box or standard meter box, suitable for housing a service or meter board.

4.4. TERMS ASSOCIATED WITH METER TESTING AND READING

Creeping

Continuous rotation of a meter disc on no load.

Reading constant — (K)

The factor by which the reading on the register of a meter is multiplied to obtain the true value of the quantity being measured.

4.5. TERMS USED IN METER INSTALLATIONS

Current-transformer metering

An arrangement in which the load current passes through CT primaries and the CT secondary current passes through the meter current coil.

Current-transformer polarity

The relationship of the instantaneous directions of current flow in the CT primary and secondary.

Direct-connected metering

An arrangement in which the load current passes through the meter current coil.

Line side

The portion of an electrical circuit closer to the energy source.

Load conductors

The cables connected to the load terminals of the meter or other instrument.

Load side

The portion of an electrical circuit closer to the load.

5. METER READING

5.1. GENERAL

Meters are provided with dial, cyclometer or digital-type registers.

One complete revolution of a pointer on a dial-type register causes the next highest pointer to rotate through one division or one tenth of a revolution. Adjacent dials rotate in opposite directions.

To read a meter, the officer shall, taking care to note the direction of the rotation of the pointers, read from the lowest to the highest, i.e. 1s, 10s, 100s and so on.

If it is doubtful whether the pointer has passed a number or not, this may be checked by observing whether the next lower pointer has completed a whole revolution. For example, if a pointer is very close to the number 8 and the next lower pointer has not reached the zero mark, the pointer in question is to be read as 7. Where however the next lower pointer has passed the zero mark, the pointer in question is to be read as 8.

The number of dials to be read on a meter is indicated by the number of digits over the highest dial, e.g. 10 000 means 5 dials.

A dial-type register is shown in Figure 1. Some dial type registers have additional dials with a painted pointer in the zero position and shall be read as a zero. Similarly, Figure 2 shows a cyclometer-type register and similarly some have two painted zeros which are read as zero. The readings of any dials registering fractions of a kWh shall be ignored.

Both readings of a dual register meter are to be recorded.

Cyclometer and digital-type registers can be read direct from the display, with the exception of the right hand moving digit on a cyclometer-type register. This must be taken as the lower figure if the figure is not completely shown.

5.2. CONSTANTS (K)

In some cases a reading constant (K) tag or label is affixed. The instrument may be initially issued with a constant tag or label affixed or it may be affixed by field staff during tests.

The constant of all direct-connected meters is 1.

However, the majority of current-transformer-connected meters have a reading constant

(K) equal to the CT ratio, e.g. if the CT ratio is 300/5

$$K = \frac{300}{5} = 60$$

When recording the reading of any meter with a constant greater than 1, the constant must be shown in the space provided on the appropriate form.

5.3. ELECTRO-MECHANICAL ENERGY-DEMAND METERS

These are provided with a dial or cyclometer type register as shown in Figures 3 and 4 and are read as set out in Clause 5.1.

The energy registers are identified by "kWh" and the demand registers by "kW".

When reading the energy register, the decimal or fractional numbers shall be ignored. However, when reading demand registers, the fractional numbers shall be read.

The kW-demand register reading is the difference between the last and present readings and is obtained when the meter is reset and the stored demand is transmitted from the lost-motion or memory gears to the demand register. The reading shall be recorded before and after each reset and in addition after working on an installation the meter is again reset and the as-left reading is recorded.

The dial-type kW-demand register shown in Figure 4 is not read.

Care must be exercised when operating the reset mechanism to ensure that it is operating satisfactorily. Any defects must be reported to the supervisor without delay so that the Electrical Installations and Customers' Accounts Branches may be notified.

5.4. ELECTRONIC MULTI-FUNCTION REGISTER, TIME-OF-USE ENERGY-DEMAND METERS

The register has a programmable electronic memory capable of storing the pulses from a pulse-generating watthour meter or a pulse summator.

These meters have a nine-digit vacuum-fluorescent display which is illuminated between 6.00 am to 6.00 pm each day and can be temporarily re-activated outside these hours using a light source. The readings begin with a display segment test of eight "8s" following which the register sequentially displays each stored reading.

The Technician is to record on Form CSS 806 the pulse-generating meter reading (in the case of summation customers, each pulse-generating meter and the summated total register) and the data and codes displayed on the EMF register.

The register is reset using the manual reset and as left readings also recorded.

Display Arrangement

*	A	A		B	B	B	B	B

* P indicates HIGHER price period
L and - indicate LOWER price period
E indicates error
A Data Identifier
B Data

Where an "E" appears in the first segment or all segments of the display test do not appear, it shall be noted on the card and reported to the E.I. Branch, Ext. 9271.

Full details of the use and reading of electronic multi-function register metering for L.V. customers are set out in draft T.I. 7315 and its attached interim instruction.

5.5. MAXIMUM DEMAND INDICATORS

Maximum-demand indicators have two pointers, a black pointer recording the maximum demand reached since the last reset and a red pointer indicating the demand at the time of reading.

Before reading, the value of the scale divisions shall be checked. Only the ampere scale of single-phase maximum-demand indicators shall be read, the kW scale, if any, being ignored. When the pointer lies between any two markings on the scale, the reading shall be recorded as the lesser.

If the pointer is beyond the maximum numbered mark on the scale, it shall be read as that value with the additional notation "above scale" or "A.S.". Where the pointer is below the minimum numbered mark on the scale, it shall be read as that value with the additional notation "below scale" or "B.S.".

Readings on marks above the maximum or below the minimum numbered marks may be of value for assessment purposes. Accordingly, the officer reading the indicator shall return the reading in the manner indicated above, but shall also record in brackets the reading indicated by the scale mark on or above which the pointer lies. For example, the reading may be returned as "B.S. 1 amp (0.5 amp)" in a below scale case.

5.6. TYPICAL REGISTERS

WATTHOUR METERS

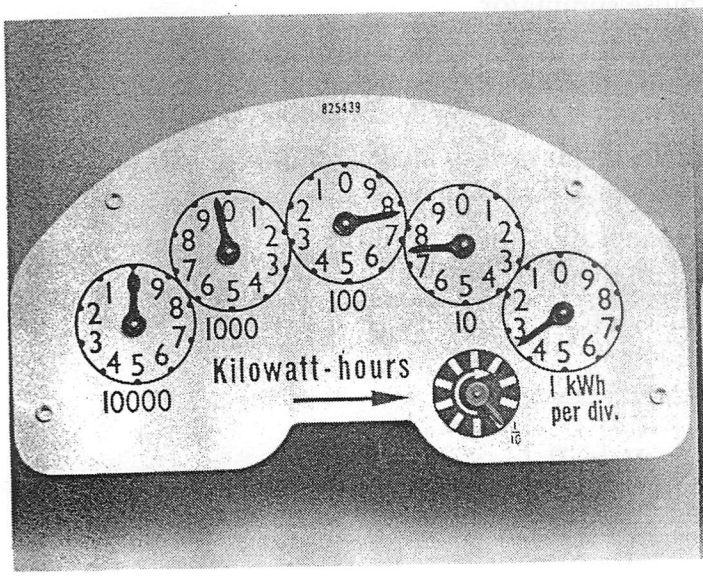


Figure 1 - Dial-type register

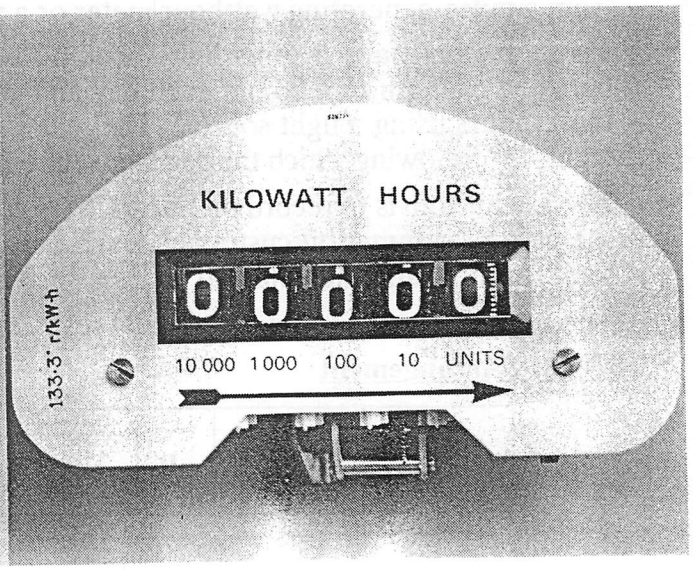


Figure 2 - Cyclometer-type register

ENERGY-DEMAND METERS

Figure 3 - Dial-type register

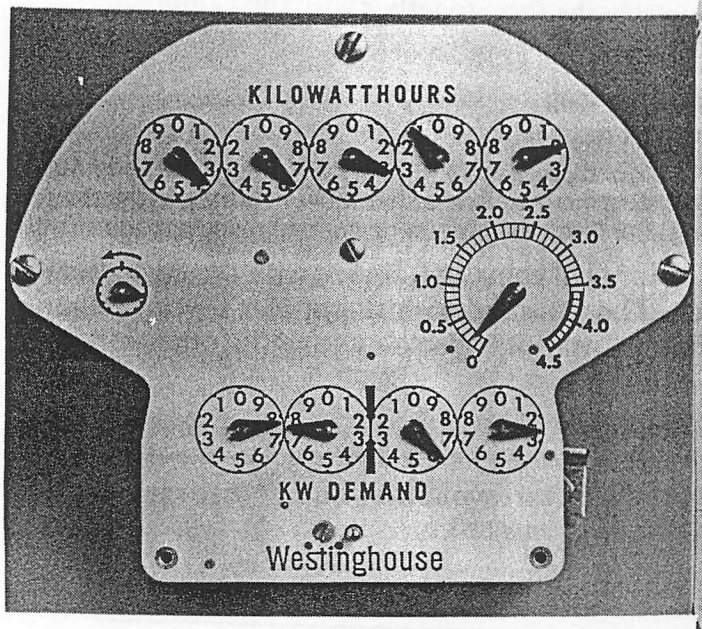
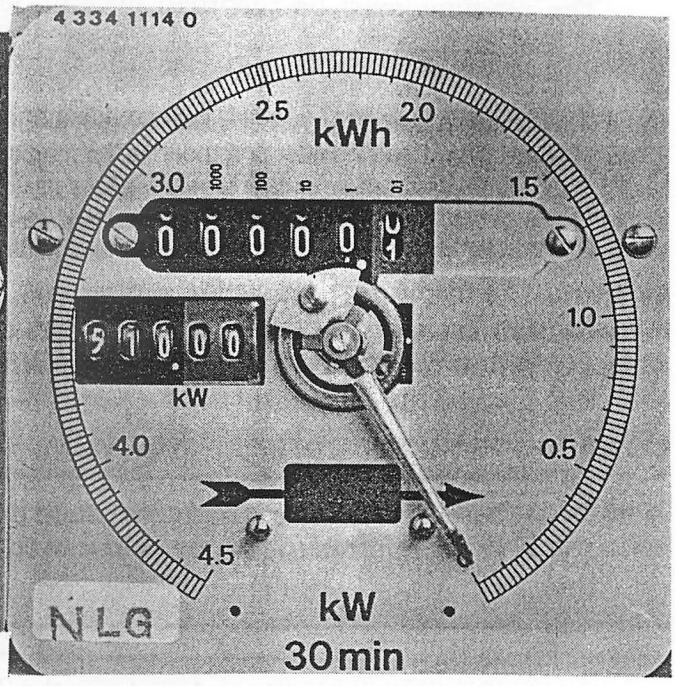
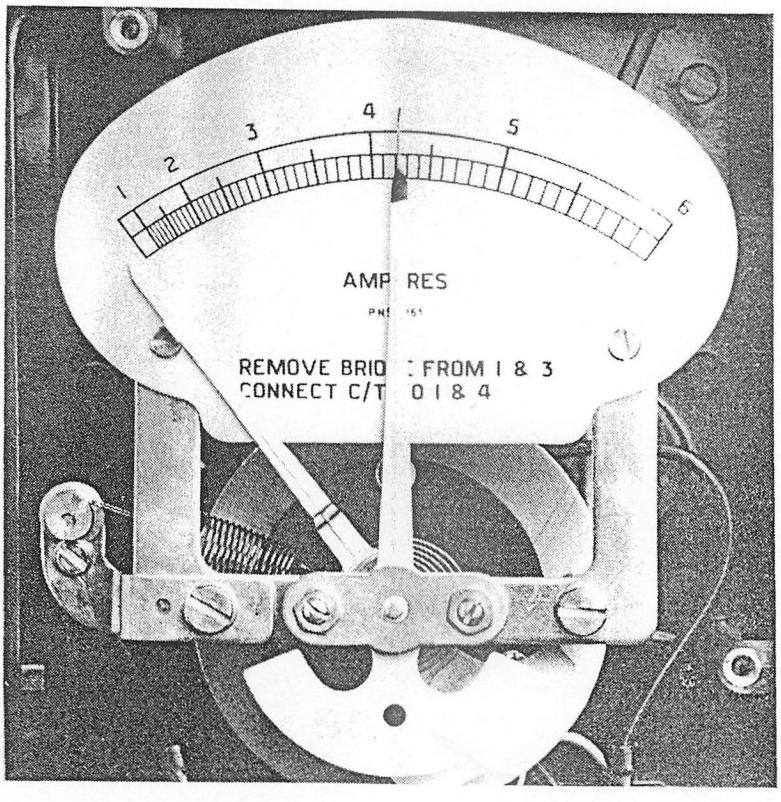


Figure 4 - Cyclometer-type register



MAXIMUM-DEMAND INDICATORS

Figure 5



5.7. RECORDING THE MAXIMUM DEMAND ON RESET FORM

When the demand mechanism of a meter is to be reset, the officer shall ask the customer's representative to check all readings prior to and after each reset.

The readings must be recorded on a CSS816 or CSS806 form as appropriate. The customer's representative shall be requested to sign the form together with the Council's officer.

Notes:

1. The "Reading as found" is the reading prior to resetting.
2. The "Reading after first reset" is the reading after resetting.
3. The "Reading as left" is the reading after a second reset so that the demand established in the memory gear train or electronic memory during testing may be disregarded. For uniformity, a "Reading as left" must be given by repeating the "Reading after first reset", where no second reset is made.

The forms are arranged in triplicate. The original copy shall be left with the customers representative, the two yellow copies shall be returned with the officer's work. One yellow copy will go to the Executive Officer - Customers' Accounts and the other will be filed by the Supervisor.

6. CREEPING

Where a meter disc is found to rotate more than one revolution without load current, it is to be reported to the supervisor so that it may be tested.

7. ISSUE

This Instruction amends and replaces the Technical Instruction issued under the same title and number in September, 1986

K Goodrick

ASSISTANT GENERAL MANAGER - ENGINEERING